FIG. 1

Steve Y. Cho, Reg. No. 44,612, (650) 326-2400
Titled: Method and Apparatus of Media Management
on Disk-Subsystem
App. No.: 10/786,566 Filed: February 24, 2004
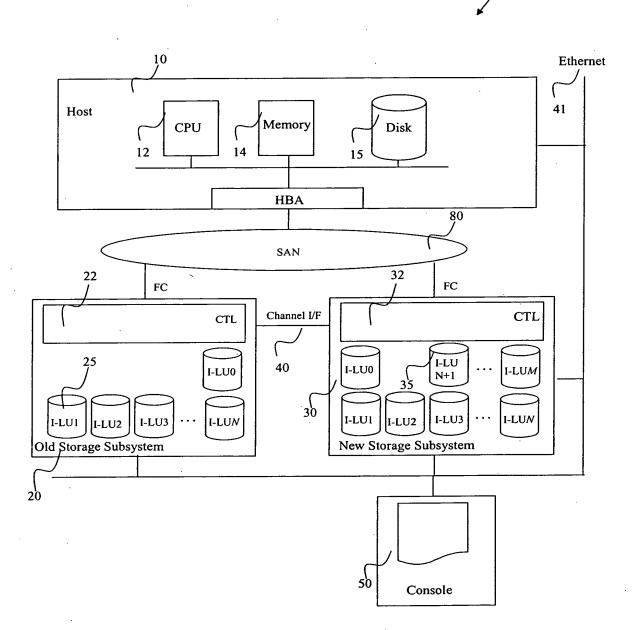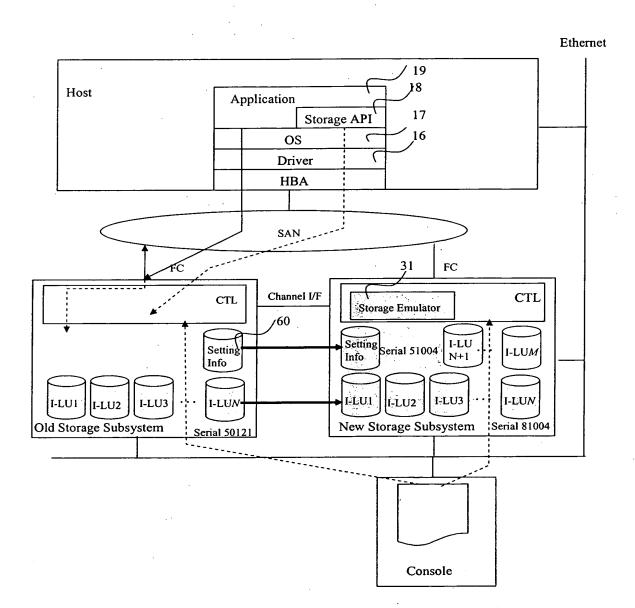Dckt. No.: 16869B-098100US
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FIG. 2

Steve Y. Cho, Reg. No. 44,612, (650) 326-2400
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App. No.: 10/786,566 Filed: February 24, 2004
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300

302 — 304 — 306 — 308

I-LU	capacity	Attribute					Permission					Retention	
		Read	Write	INQUIRY	Read capacity	SVOL	Read	Write	INQUIRY	Read capacity	SVOL	Start date	Remaining days
1	3.3GB	Enable	Enable	Enable	Correct	Enable	Permit	Permit	Permit	Permit	Permit		
2	3.3GB	Enable	Disable	Enable	Correct	Disable	Permit	Deny	Permit	Permit	Deny	2001/08/03	768
3	3.3GB	Disable	Disable	Enable	Correct	Disable	Deny	Deny	Permit	Permit	Deny	2001/08/03	368
4	3.3GB	Disable	Disable	Disable	Correct	Disable	Deny	Deny	Deny	Permit	Deny	2001/08/03	185
5	3.3GB	Disable	Disable	Disable	0	Disable	Deny	Deny	Deny	Deny	Deny	2001/01/26	1204
...		...	...	...	...	...	...	...	...	...	...	...	...
N		...	...	...	...	...	...	...	...	...	...	...	...

FIG. 3

Steve Y. Cho, Reg. No. 44,612, (650) 326-2400
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App. No.: 10/786,566 Filed: February 24, 2004
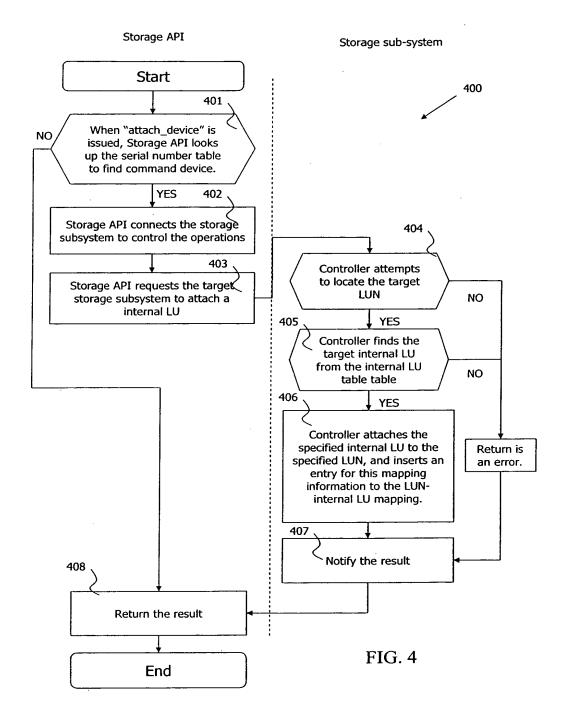Dckt. No.: 16869B-098100US
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Storage API   Storage sub-system

400

Start

401

NO

When "attach_device" is
issued, Storage API looks
up the serial number table
to find command device.

YES   402

Storage API connects the storage
subsystem to control the operations

403

Storage API requests the target
storage subsystem to attach a
internal LU

404

Controller attempts
to locate the target
LUN

NO

405

Controller finds the
target internal LU
from the internal LU
table table

NO

YES

406

Controller attaches the
specified internal LU to the
specified LUN, and inserts an
entry for this mapping
information to the LUN-
internal LU mapping.

Return is
an error.

407

Notify the result

408

Return the result

End

FIG. 4

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Serial #	Command Device	
	WWN	LUN
50121	10.00.00.00.C9.36.07.D7	0
50123	10.00.00.00.C9.36.07.AD	254
...	...	...

FIG. 5

WWN	LUN	I-LU
10.00.00.00.C9.36.07.D7	1	23
10.00.00.00.C9.36.07.D7	2	2
...	...	...

FIG. 6

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Storage API   Storage sub-system

Start

700

701
When "detach_device" is
issued, Storage API looks
up the serial number table
to find command device.

NO   YES

702
Storage API connects the storage
subsystem to control the operations

703
Storage API requests the target
storage subsystem to attach a
internal LU

704
LUN is used?   NO

YES

705
Exist the target
internal LU?   NO

YES

706
Controller detaches the
specified internal LU to the
specified LUN, and inserts an
entry for this mapping
information to the LUN-
internal LU mapping.

Return
is an
error

707
Notify the result

708
Return the result

End

FIG. 7

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Console   Old   New
                           storage   Storage
                           Sub-subsystem   Sub-system

```
           ┌─────────────────────────────┐
           │           Start             │
           └─────────────────────────────┘
                          │                                              800
      ┌───────────────────▼───────────┐
  801 │   Operator requests           │
      │   migration of internal LUs   │
      │   and setting information      │
      └───────────────────┬───────────┘
      ┌───────────────────▼───────────┐
      │   Request the copy            │
  802 │   operation for volumes from  │
      │   old storage subsystem to    │
      │   new storage subsystem       │
      └───────────────────────────────┘                        803
                                                    ┌───────────────────┐
                                                    │  Initiate a data copy │
                                                    │  from old volume to   │
                                                    │  new volume           │
                                                    └───────────────────┘
                                                 804
                                                    ┌───────────────────┐
                                                    │  Collect the setting  │
                                                    │  information from old │
                                                    │  volume to new volume │
                                                    └───────────────────┘
                                                 805
                                                    ┌───────────────────┐
                                                    │ Initialize emulation of│
                                                    │ old storage subsystem's│
                                                    │ serial number and      │
                                                    │        WWN             │
                                                    └───────────────────┘
              806
           ┌───────────────────────┐
           │   Suspend I/O process │
           └───────────────────────┘
                                                 807
                                                    ┌───────────────────┐
                                                    │   Activate the path   │
                                                    └───────────────────┘
           ┌─────────────────────────────┐
           │           End               │                    FIG. 8
           └─────────────────────────────┘
```

FIG. 8

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App. No.: 10/786,566 Filed: February 24, 2004
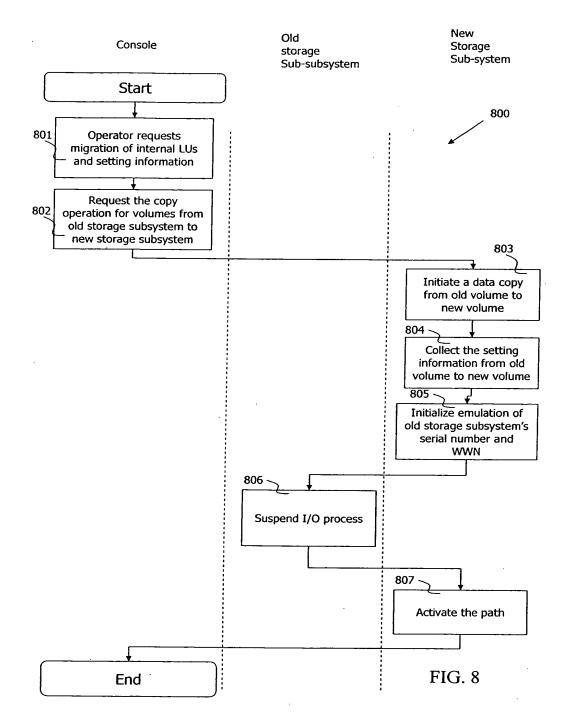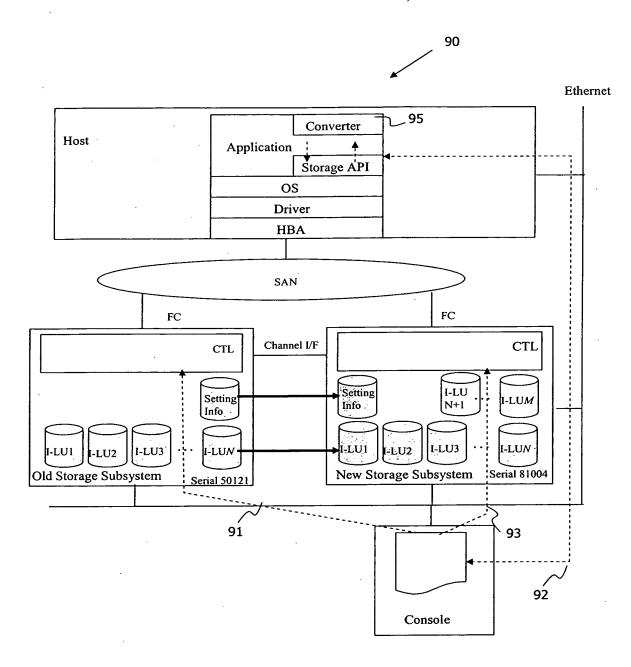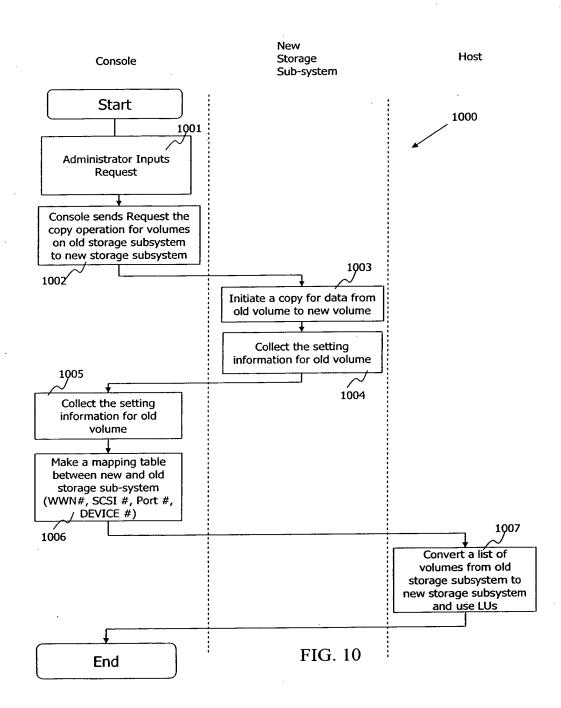Dckt. No.: 16869B-098100US
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90

Ethernet

Host

Converter ⌇ 95

Application

Storage API

OS

Driver

HBA

SAN

FC

FC

CTL

Channel I/F

CTL

Setting
Info

Setting
Info

I-LU
N+1

I-LU*M*

I-LU1

I-LU2

I-LU3

I-LU*N*

I-LU1

I-LU2

I-LU3

I-LU*N*

Old Storage Subsystem

Serial 50121

New Storage Subsystem

Serial 81004

91

93

92

Console

FIG. 9

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on Disk-Subsystem
App. No.: 10/786,566 Filed: February 24, 2004
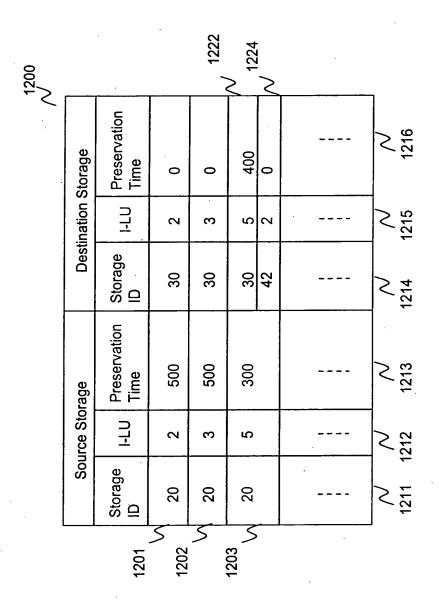Dckt. No.: 16869B-098100US
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Console   New Storage Sub-system   Host

```
           ┌─────────────────────┐
           │        Start        │
           └─────────────────────┘
                     │ 1001
                     ▼
           ┌─────────────────────┐
           │ Administrator Inputs│
           │      Request        │
           └─────────────────────┘
                     │
                     ▼
           ┌─────────────────────┐
           │ Console sends Request│
           │ the copy operation  │
           │ for volumes on old  │
           │ storage subsystem   │
           │ to new storage      │
           │ subsystem           │
           └─────────────────────┘
              1002
```

1003 — Initiate a copy for data from old volume to new volume

1004 — Collect the setting information for old volume

1005 — Collect the setting information for old volume

1006 — Make a mapping table between new and old storage sub-system (WWN#, SCSI #, Port #, DEVICE #)

1007 — Convert a list of volumes from old storage subsystem to new storage subsystem and use LUs

```
           ┌─────────────────────┐
           │         End         │
           └─────────────────────┘
```

1000

FIG. 10

1102

Before copy

I-LU	Attribute Read	Attribute Write	Attribute INQUIRY	Attribute Read capacity	Attribute SVOL	Permission Read	Permission Write	Permission INQUIRY	Permission Read capacity	Permission SVOL	Retention Start date	Retention Remaining days
1	Enable	Enable	Enable	Correct	Enable	Permit	Permit	Permit	Permit	Permit		
2	Enable	Disable	Enable	Correct	Disable	Permit	Deny	Permit	Permit	Deny	2001/08/03	768
...	...	...	...	...	...	...	...	...	...	...	...	...
8	Enable	Enable	Enable	Correct	Enable	Permit	Permit	Permit	Permit	Permit	.	.
...	...	...	...	...	...	...	...	...	...	...	...	...
N												

After copy

I-LU	Attribute Read	Attribute Write	Attribute INQUIRY	Attribute Read capacity	Attribute SVOL	Permission Read	Permission Write	Permission INQUIRY	Permission Read capacity	Permission SVOL	Retention Start date	Retention Remaining days
1	Enable	Enable	Enable	Correct	Enable	Permit	Permit	Permit	Permit	Permit		
2	Enable	Disable	Enable	Correct	Disable	Permit	Deny	Permit	Permit	Deny	2001/08/03	768
...	...	...	...	...	...	...	...	...	...	...	...	...
8	Enable	Disable	Enable	Correct	Disable	Permit	Deny	Permit	Permit	Deny	2001/08/03	768
...	...	...	...	...	...	...	...	...	...	...	...	...
N												

1104

Host
Application
Storage API
OS
Driver
HBA

SAN

CTL

Setting Info

ILUN

ILU8

ILU2

FIG. 11

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1200

Source Storage			Destination Storage		
Storage ID	I-LU	Preservation Time	Storage ID	I-LU	Preservation Time
20	2	500	30	2	0
20	3	500	30	3	0
20	5	300	30	5	400
			42	2	0
----	----	----	----	----	----

1201 1202 1203

1211 1212 1213 1214 1215 1216

1222 1224

FIG. 12

1200

| Source Storage | | | Destination Storage | | |
Storage ID	I-LU	Preservation Time	Storage ID	I-LU	Preservation Time
20	2	200	30	2	0
20	3	200	30	3	0
30	5	400	42	2	0
----	----	----	----	----	----

1211 1212 1213 1214 1215 1216

1201' 1202' 1203'

FIG. 13